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## The Distinction Between Static and Dynamic Models

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The Distinction Between Static and Dynamic Models

Economic models include both stock and flow variables. From the point of view of short run decisions, the stock variable can be considered as part of the environment within which the flow of income and employment are determined. However, as was pointed out earlier, a major problem of monetary theory is to evaluate the effect of monetary-financial environment upon the division of current income between investment and consumption. But of course net investment is a net change in stocks, and hence affects the environment within which flow variables such as income are determined. A complete, or perhaps a better label is a natural, monetary theory would take up the effect of these endogenously determined changes in the environment within which short run decisions are made. Hence monetary theory because it considers the effects of both the real and the financial residue of investment, must be dynamic; i.e., it must be concerned with the effect of changing environments upon the behavior of the economy.

In addition to the feedback from current flows to changes in stocks as a result of investment, there are additional dynamic elements which are always operating to change the environment within which current decisions are made: Technological, population, and institutional changes all affect the equilibrium values of the flow variables. Although these dynamic factors are related to and to a considerable extent are determined by market processes, the relation between these changes and the behavior of the monetary-financial system is not at all obvious. On the other hand net investment not only has a real effect in changing productive capacity, it also has an effect upon financial relations due to the imputations of the value of net

investment (including the government deficit) to the net worth of households and firms. Net investment in a private enterprise economy changes the value of the financial assets of households and the value of the financial liabilities of business firms and governments. Hence within the framework of monetary theory there is an element which endogenously induces a dynamic process; in addition the impact of exogenously determined population, technological and institutional changes upon the behavior of a monetary economy must be examined.

Even though Monetary Theory is essentially dynamic, there are static monetary models. Two varieties of static models can be distinguished. In one set the change in the stock variables are assumed to be zero. This is the artifact of adopting a stationary state as the basis for analysis. Whereas the postulate of a stationary state has been very useful in elucidating the characteristics of the price and distribution attributes of an economy, the abstraction from investment and its dynamic effects is not as useful in monetary economics. The most useful static models are those in which investment is not of necessity equal to zero.

The only way in which you can have a static model in Monetary Theory even though investment is not necessarily zero is by assuming that the change in the stock variables that result from investment is so small, in the time period under consideration, that the feedback from the change in the stocks to the change in the rate of flows will be negligible. These static models therefore break with the natural dynamism in monetary phenomena usually in order to focus attention upon the effect of changes in other variables upon the behavior of the system. However it is important to remember that the feedbacks from investment that are ignored for such short period analysis cannot be ignored in any analysis which attempts to stretch the time path of flow variables over longer periods of time.

Analagous to the abstraction from the effect of investment upon the productive capacity and the financial relation of an economy, is the assumption often made in monetary theory that the time rate of change of a particular set of variables is much slower than that of other variables. This leads to the assumption that the initial equilibrating process will not involve any significant changes in the value of the variables which move slowly. The path to equilibrium will be affected by the possible rates of change of particular variables, and these possible rates of change are usually the result of institutional characteristics.

One more point should be made in discussing the distinctions between statics and dynamics. Any stable equilibrium of a static model is the limit of an adjustment process: there is a form of dynamical analysis buried in the assumption that an equilibrium is stable. We can call such dynamics the dynamics of the path toward equilibrium. However the precise path that is taken does not affect the equilibrium values. The dynamics centering around the impact of investment, financial variables, technological change and population growth result in changing the equilibrium of the static model which would result if we abstracted from the effect of these dynamic factors. This dynamics is the dynamics of the changing equilibrium of the imbedded static system.

The endogenous dynamics of changing equilibria depend upon the changes in the stocks as well as the nature of investment and financial instruments. The changes that occur in these variables do depend upon the path that is taken toward the implicit static equilibria as well as the effects of the changes in the capital and financial stocks. But the path to equilibria, as well as the path of adjustment to an exogenous change depend upon the institutional characteristics of the markets which must react. By

affecting these market adjustment processes, institutional changes affect the dynamics that involve changing equilibria.

Of course there is an equilibrium of changing equilibria the idea of such an equilibrium is that of a process which unless disturbed will continue, just as static equilibria revolves a set of variables which, unless changed, will not change. This dynamic equilibria usually results in propositions about constant rates of changes and constant ratios among the variables of the model. These balanced dynamical systems play somewhat the same role in dynamic theory as the stationary state plays in equilibrium theory.

This view of balanced dynamic processes, of an equilibrium dynamics, requires not only that population change be consistent with the change in the non-human factors but also that the technological and institutional changes be consistent with the requirements for balanced growth. Hence the attempt to define an equilibrium process which is consistent with accumulation, financial changes and population growth results in a need to specify the required impact of technological change upon the labor and capital requirements.

The problem of the institutional requirements for such balanced dynamic processes has been neglected.

In addition scant attention has been paid to the financial balance requirements of such balanced dynamics. Analogous to the nature of the technological changes needed to satisfy the requirements for a balanced dynamic process there are the asset preference changes which are needed in order to make financial asset and liability owners satisfied with the financial repercussions of a balanced dynamic process involving the real sector.

To summarize we can say that monetary analysis is essentially dynamized, but the dimensions to the dynamical system are such that dynamical balance requires that many variables as well as underlying technical and preference systems change in a consistent manner. The basic gain from examining such complex balance requirements is not that we expect the economy to behave in such a balanced manner but rather that the complexity of the requirements is evidence that on the whole we can expect dynamical processes to be "unbalanced". If unbalanced dynamical processes are more likely than not to be operative then the expectation is that strains and stresses will occur in the dynamical process. These will result in variations in the rate of change of the various variables: variations which although they may not be truly periodic will be such that economists will call them cyclical. And there is no "a priori" reason not to believe that the amplitude and duration of the accelerated and decelerated rates of changes will upon occasion lead to severe or deep decline or sharp and rapid increases. A nonbalanced dynamical process will be cyclical and can result in deep declines. Hence a real task of monetary theory is to examine the dynamical growth process to determine the conditions under which sufficient imbalance can occur to lead to marked deviations from the balanced dynamical path.

1. Note that a reservation price for capital services is derived from individualistic decision making whereas for labor services this phenomenon depends upon collective action.

2. Foley and Sidrauski (A.S.R. 1970) see the equilibrium-disequilibrium aspects of the investment problem but they run off the track when they put it in a full employment framework. The imposition of a dominant production efficiency frontier is not permissible for the range of problems under consideration.

3. The essence of the banality of the neoclassical position has been well stated by Patinkin when he summarized his conclusions in the final paragraph of his introduction. If further evidence of the banality of this position is needed one need not look beyond the recent Friedman articles in which his "radical" position reduces to a rephrasing of Patinkin.

4. Within money creation there may well be differences between money created in the process of financing demand and money created by substitution in portfolios. If such differences exist they might very well show up in the time it takes for responses to develop to stimuli (the lag structure) and the difference between modes of money creation may very well depend upon the past of the systems. To the extent that statistical analysis is carried on by using data corrupted by averaging - such as is true of "permanent" concepts of income and money - these differences will be obscured.

5. Note that the quasi-rents and the user costs both are gross profit concepts. It is perfectly possible for gross profits to rise as a proportion of gross national product while net profits decline. Furthermore if

full employment quasi-rents are in considerable excess of user costs then an initial decline in quasi-rents may take place without any decline in quantity supplied, labor employed. In these circumstances capital's share will first fall and then be sustained.